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A foundation for change

Hiperpile Technical Datasheets

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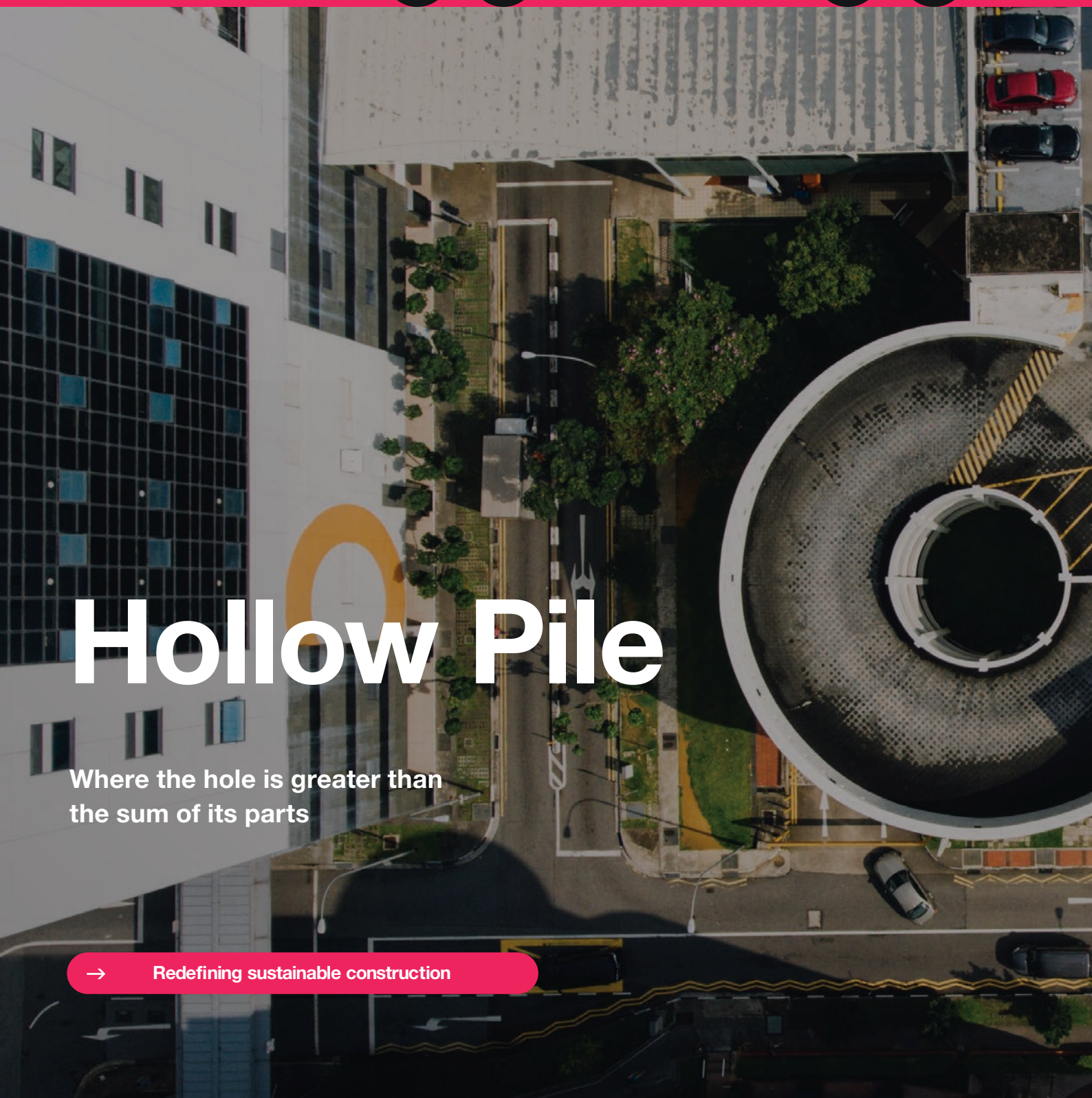
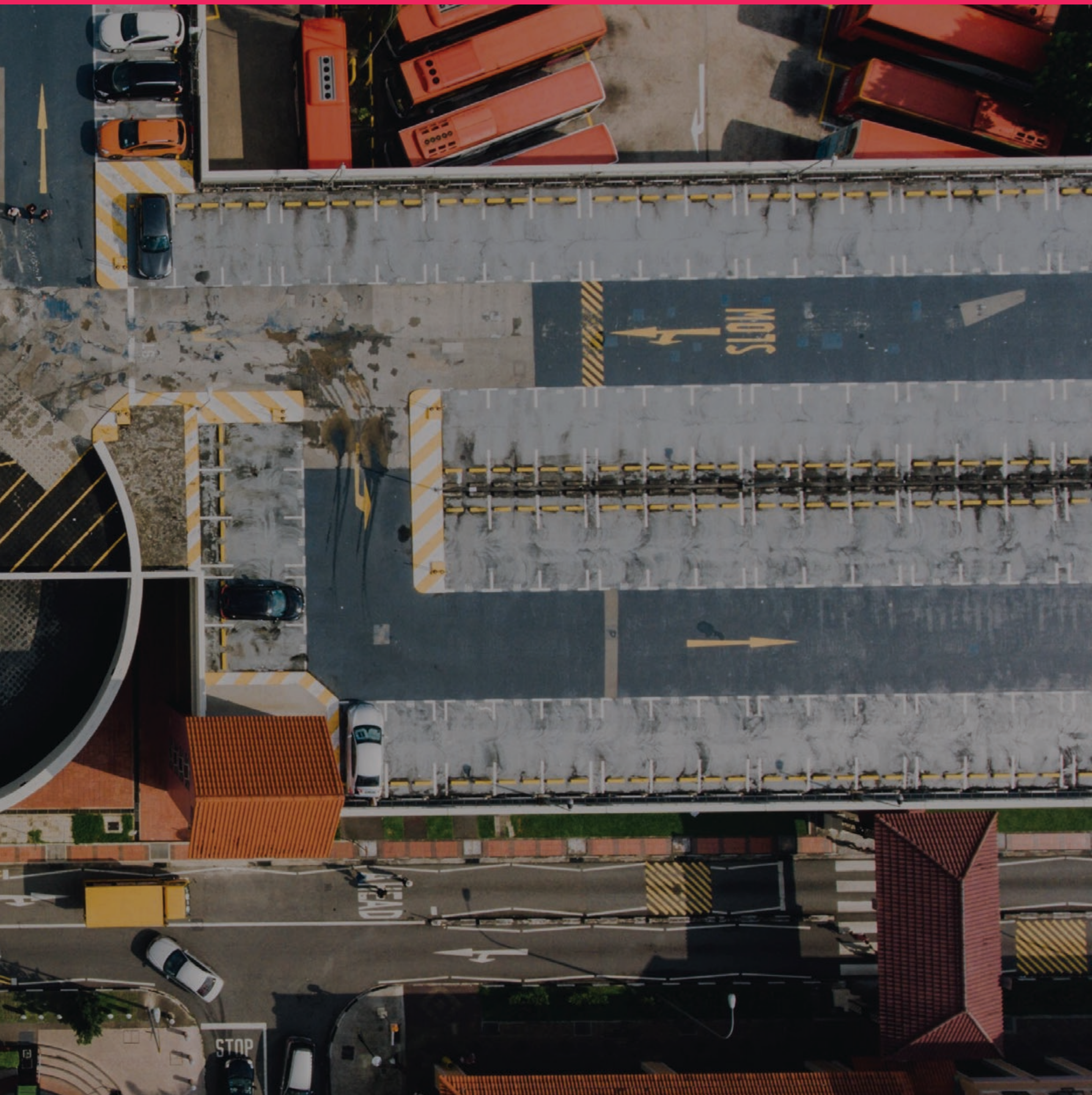


Hollow Pile

Where the hole is greater than
the sum of its parts

→ Redefining sustainable construction


SLOW
STOP

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Hollow Pile

Where the hole is greater than the sum of its parts

Hiperpile constructed with a hollow void significantly reduces material use and embodied carbon, propelling the ground engineering industry towards a Net-Zero future.

Technical benefits and features

The hollow void is constructed using one of two methods:

- Where reinforcement and in-situ concrete is placed externally around a void forming liner positioned centrally to the bore
- Or using precast elements (see Precast data sheet for further details)

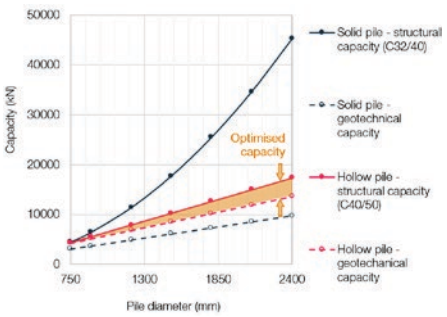
- In-situ hollow piles - Pile bored diameters of 750mm to 1500mm are available with a void ranging between 350mm and 1100mm in diameter

- The concrete wall thickness varies between 200mm and 300mm, dependent on structural loading conditions

- A solid base and top section provide base capacity and a suitable connection to the structure

- Axial, lateral and bending resistance are all designed in accordance with relevant codes and standards

- The Hollow pile is a patented product



Piled foundations are routinely designed with structural capacities that far exceed the geotechnical capacity; this unsustainable design results in the inefficient use of construction materials.

Central to the Hiperpile product is the hollow void, critical in reducing concrete volumes which is the primary contributor to the embodied carbon intensity of deep foundations.

We have developed hollow void construction methodologies using cast in-situ and precast techniques for a diverse range of structural loads and ground conditions.

Larger piles can support higher lateral loads and bending moments, therefore substructure pile caps can be reduced in size. Significant combined carbon savings are generated from smaller pile caps and large diameter carbon efficient foundations.

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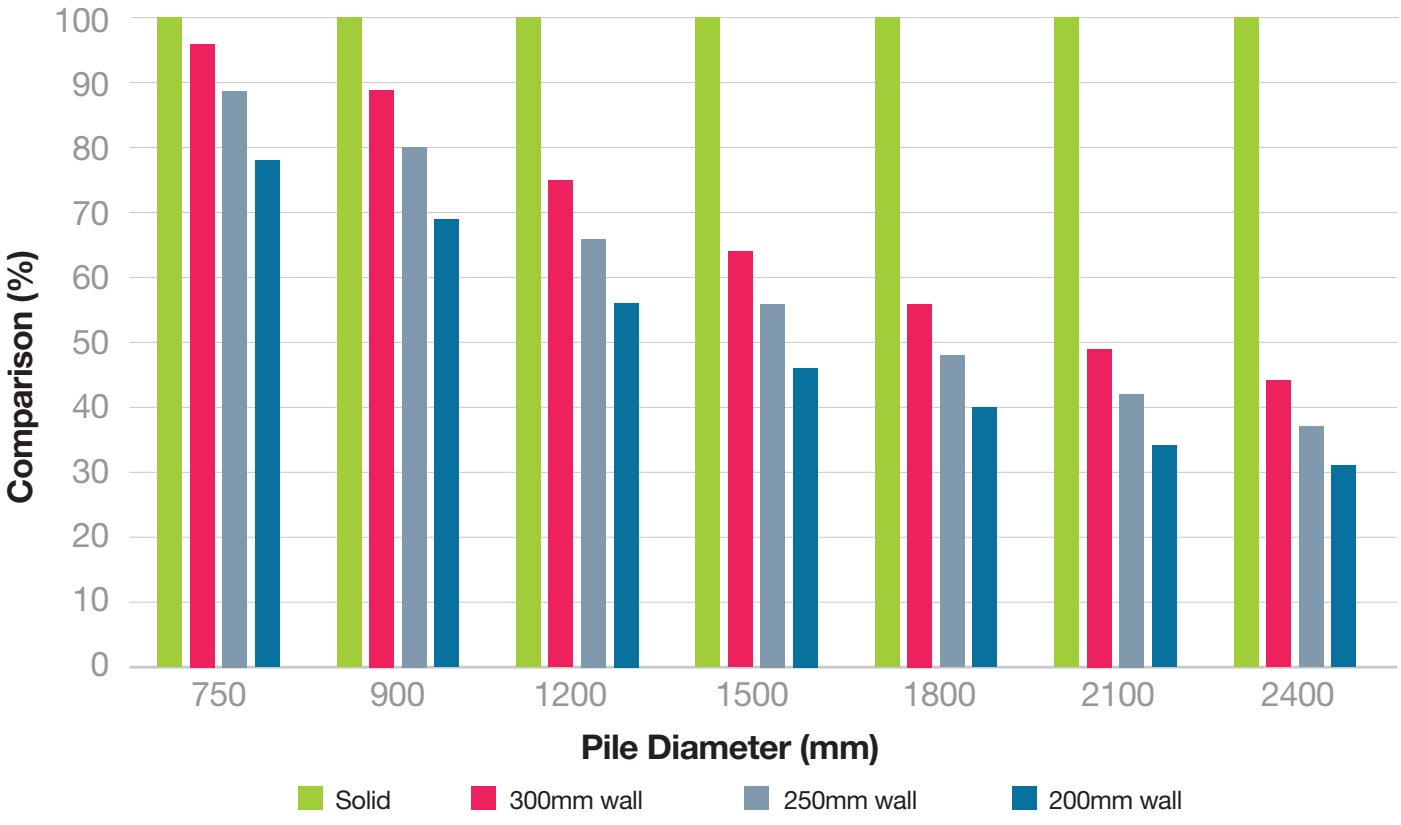
Tangible benefits

- Reduces material volume by 30%-70% (pile diameter dependent)
- Reduces embodied carbon by 20%-50%
- The hollow void unlocks geothermal energy storage and generation potential
- The hollow void may be utilised for storing backfill material or water attenuation
- Reduces associated material deliveries and vehicle movements by up to 40%
- Reduction in site activities and associated H&S and environmental risks
- Reduction in overall sub-structure carbon by reducing reliance on large pile caps

Hollow Pile material saving



In summary

The hollow pile optimises concrete consumption against structural load capacity; the larger the pile diameter, the greater the embodied carbon saving.

Additionally, hollow piles facilitate the transition from the traditional multiple-pile cap design approach to smaller pile caps or more resource-efficient monopile solutions.

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Impression Pile

Making a lasting impression

→ Redefining sustainable construction


ZONE
SAFETY

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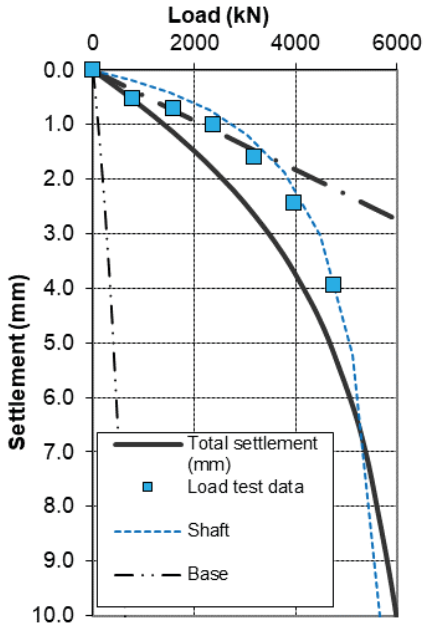
Impression Pile

Making a lasting impression

Enhancing pile shaft friction is the key to increased load bearing capacity, reduced embodied carbon, and reduced spoil volumes on site. Through continuous development we have refined the design method and installation process to maximise stakeholder benefit.

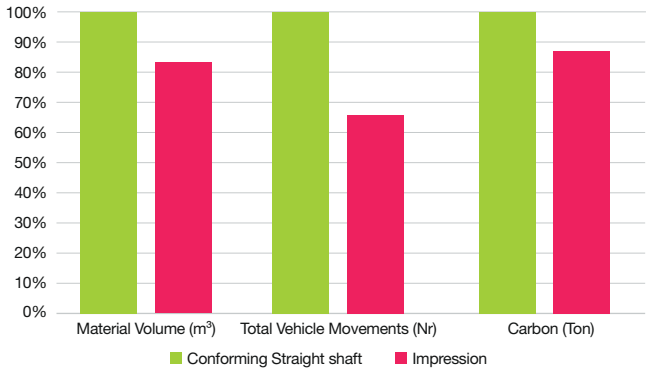


Background/Motivation

The Impression pile was developed to enhance the shaft capacity of dry bored piles, and therefore permit shorter piled foundations.

This not only reduces the embodied carbon, but can also avoid augering into water bearing strata. This reduces the project cost, improves the quality of the pile construction and enhances overall site productivity.

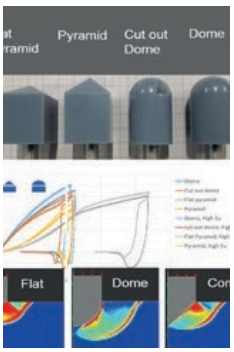
Analysis of 150Nr 900mm dia. piles, SLS load 4MN



Standard pile capacity vs impressed pile capacity. Graph showing reduction in concrete volumes and spoil volume

Technical

- The impression tool is a bespoke hydraulically operated device, covered by two patents
- Piles can be impressed in a range of bore diameters from 600mm to 1500mm, typically to depths of 30m
- Construction starts with a bored pile that is then impressed and the base then is cleaned
- Piles are designed to Eurocodes and installed in accordance with BS EN 1536
- Pile testing recommendations in accordance with ICE SPREW (2017)
- Enhanced working capacity of 25% per pile
- A ductile failure mechanism rrather than a brittle one



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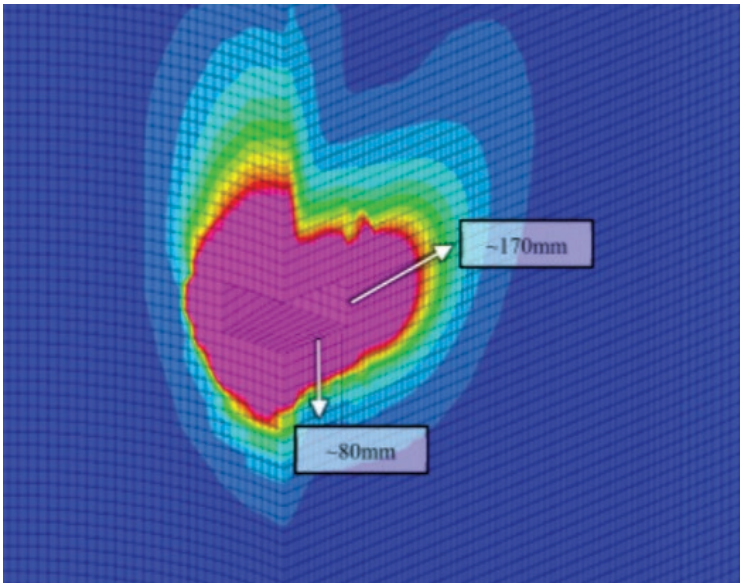
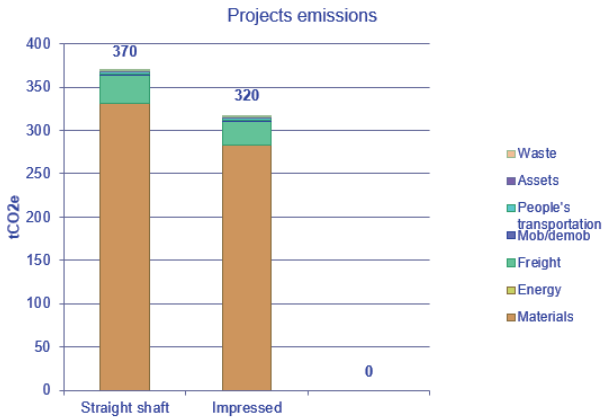
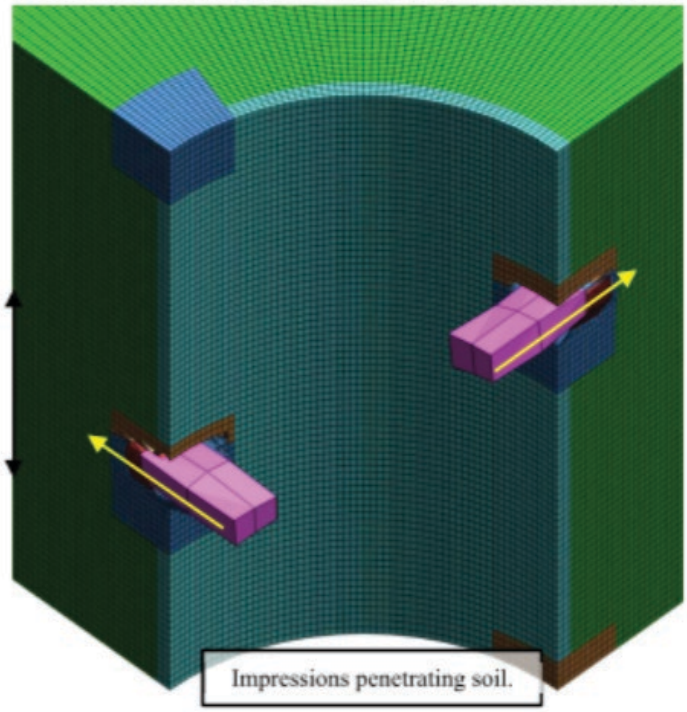
Tangible benefits

- Reduced project costs compared with straight shafted bored piles
- Reduced pile depth and/or diameter
- Reduced material volume quantities, typically 10%-20%
- Up to 40% reduction in vehicle movements from concrete and spoil
- Up to 15% saving in embodied carbon from the piles alone
- Production rates not adversely impacted compared with a shafted pile
- Live feedback from the pile bore during construction
- Shorter, higher capacity piles may avoid the need for polymer supports fluid



Carbon calculation showing analysis of 150Nr 900m dia. piles for a working capacity of 4MN





In summary

Our Impression pile is a repeatable, reliable construction technique, generating efficiencies through design. Impression piles enhance pile capacity, reduce material volumes, reduce total vehicle movements and ultimately embodied carbon savings.

Impression piles are ideally suited to dry bores in normally consolidated and over-consolidated clays such as those found within the geology of the London Clay basin.

Extensive small-scale and large-scale pile tests have been completed on a range of pile diameters. A simple analytical design method has been developed, derived and published by independent consultants.

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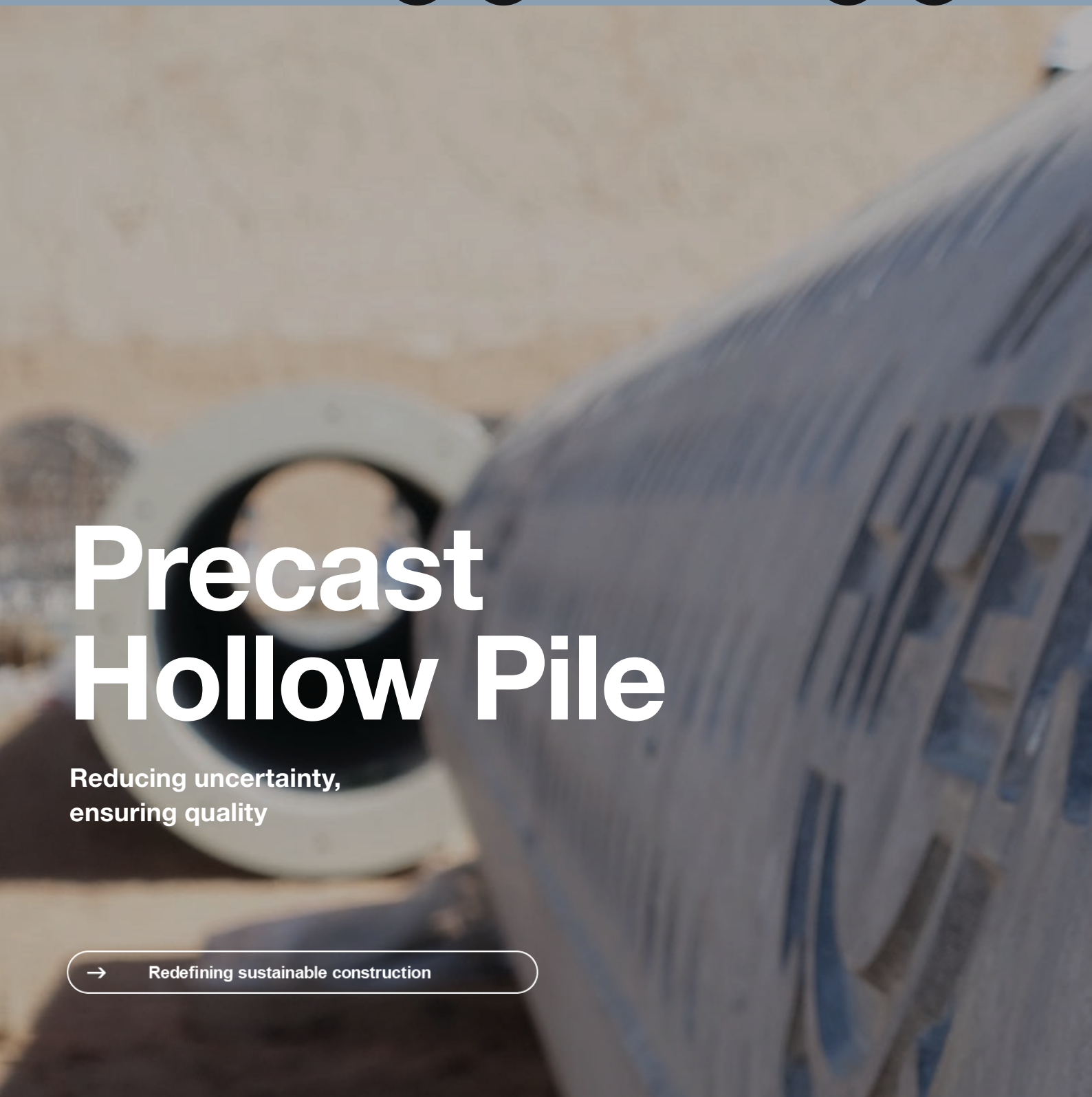

Precast Hollow Pile

Reducing uncertainty, ensuring quality

→ Redefining sustainable construction

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Precast Hollow Pile

Reducing uncertainty, ensuring quality

Hiperpile redefines large-diameter pile construction using prefabricated structural elements, manufactured in quality-controlled, offsite facilities.

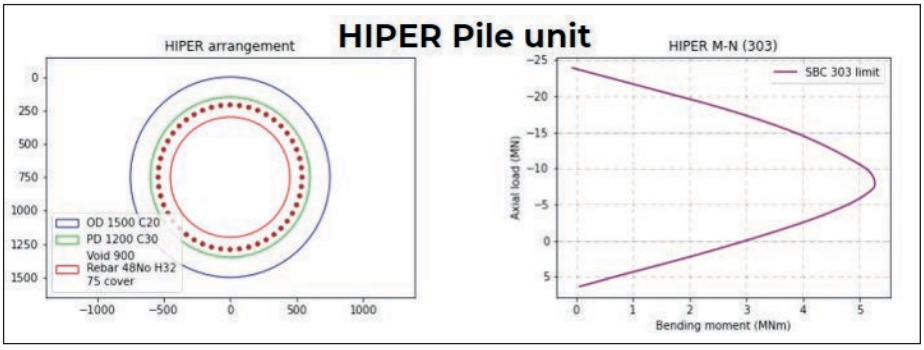
Technical details and benefits

- Precast hollow piles are suitable for very high structural loads and can be installed under “wet” fluid support or “dry” bore conditions
- Available in pile diameters from 900mm to 1800m with void diameters ranging between 500mm to 1300m. Precast unit lengths can be designed to suit any project requirements
- Precast units are lowered into a larger diameter pile bore to the design cut-off level, and concrete is placed in-situ to the external face of the precast unit. This enables load transfer from the structure into the ground
- Precast sections are designed in accordance with relevant codes and standards
- Precast units and splice connections can be designed to accommodate and transfer large axial, lateral, tension forces and bending moments between segments
- Precast units can significantly reduce tension reinforcement associated with short term heave conditions
- Inherent ability to de-bond skin friction without the requirement for expensive bitumen coated liners
- Suitable for highly aggressive ground conditions
- The structural design of the precast units considers high strength concrete with tailored reinforcement to satisfy the loading conditions throughout the length of the pile
- Bespoke head connection details can be detailed for pile caps and columns
- Standardised design prevents avoidable non-conformances
- Design suitable for seismic leading conditions

Hollow precast piles unlock the application of Hiperpile in large diameter, deep rotary bored foundations, enhancing construction quality and guaranteeing delivery certainty, resulting in large material & embodied carbon savings.

Traditional deep, large diameter, solid piles require large volumes of concrete, resulting in a high number of vehicle movements.

By supplying off-site manufactured precast pile units on a ‘just in time’ basis, we significantly reduce total vehicle movements to your project.



Tangible benefits

- Reduced embodied carbon compared to solid piles by up to 30%
- Enables thermal energy storage and generation within the hollow void
- Reduces vehicle movements typically by 15-30%
- Increased certainty and quality of construction, extending the design working life and ensuring that piles can be re-used for future generations
- Piles cast to high degrees of tolerance, minimising construction waste
- Reduction in overall construction programme from reduced pile trimming activities and “kit of parts” construction
- Reduced requirement and associated costs of integrity testing
- Reduced material usage by up to 30%
- Health & Safety is enhanced through a significant reduction in pile trimming and a reduced number of vehicle movements to site

In summary

High-quality, offsite manufactured precast piles facilitate the transition from ‘construction to production’ in an industry that has historically been reluctant to change. With improved quality comes the opportunity to provide an enhanced warranty and an improved design life.

Off-site manufacture allows for both standardised production, the opportunity for bespoke detailing to suit specific project requirements, and the carbon benefit of varying the structural design to match the anticipated loadings along the pile length.

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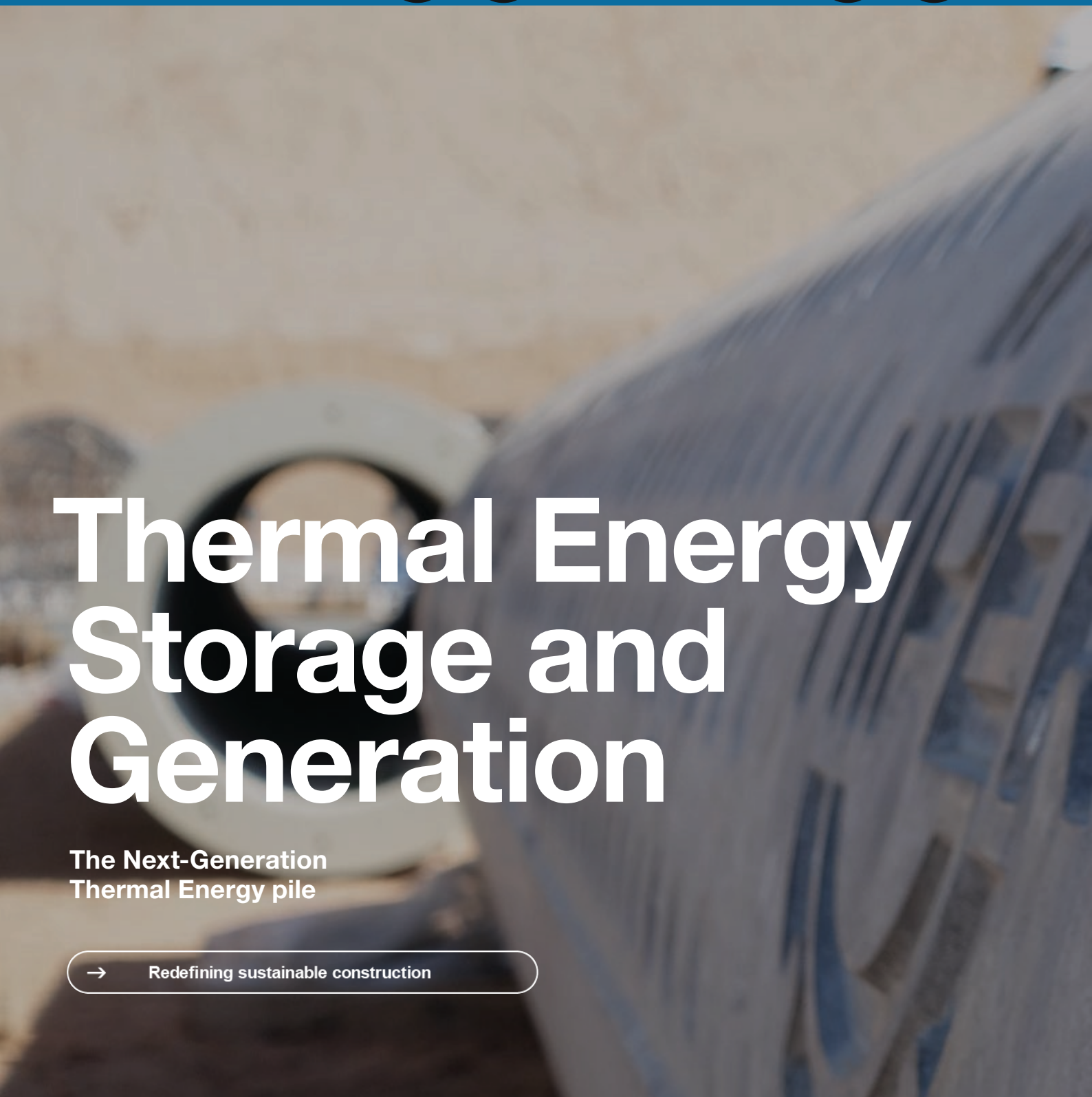

Thermal Energy Storage and Generation

The Next-Generation Thermal Energy pile

→ Redefining sustainable construction

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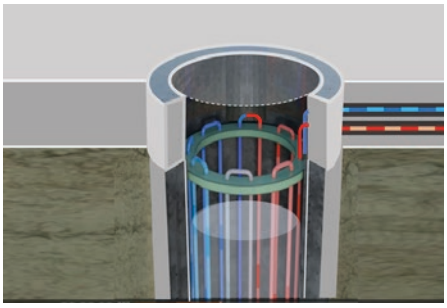
Thermal Energy

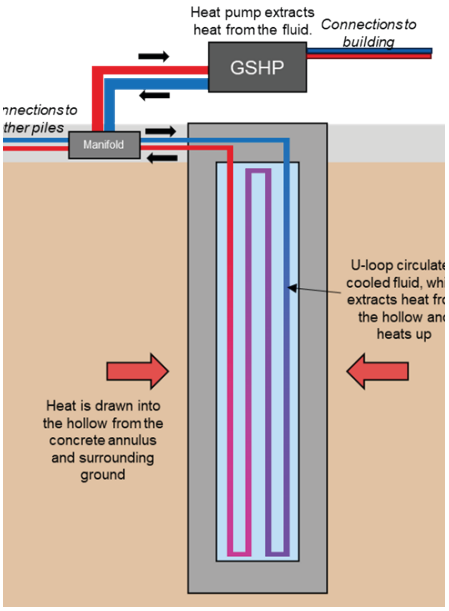
The next generation thermal energy pile

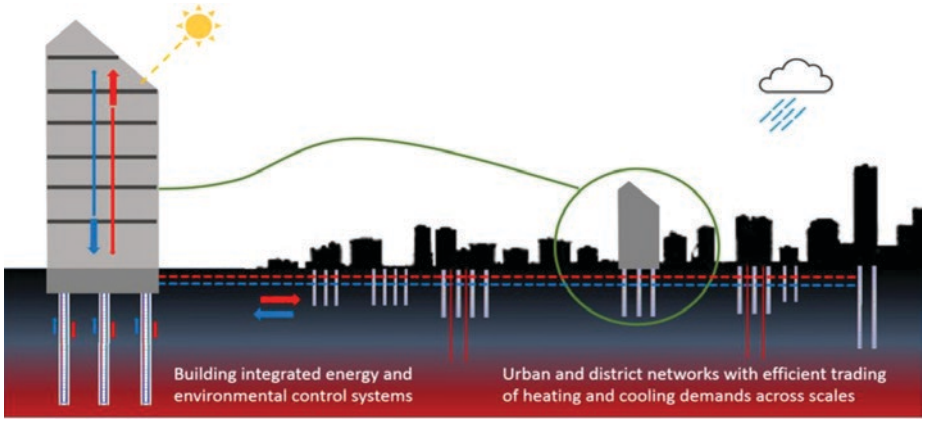
Harnessing ground-source energy, coupled with the latest heat pump technology, the Hiperpile achieves outstanding operational carbon reductions. Ground-source energy solutions, boasting efficiencies twice that of air-source systems, form the bedrock of Hiperenergy's sustainable approach



The patented Hiperpile utilises the high thermal capacity of the water-filled void to store thermal energy in the short term and exchange heat energy with the ground in the mid to long term.

This enables the foundation itself to meet extremely high, short-term peak loads whilst also utilising the surrounding ground to meet seasonal (mid term) and annual demand (long term).



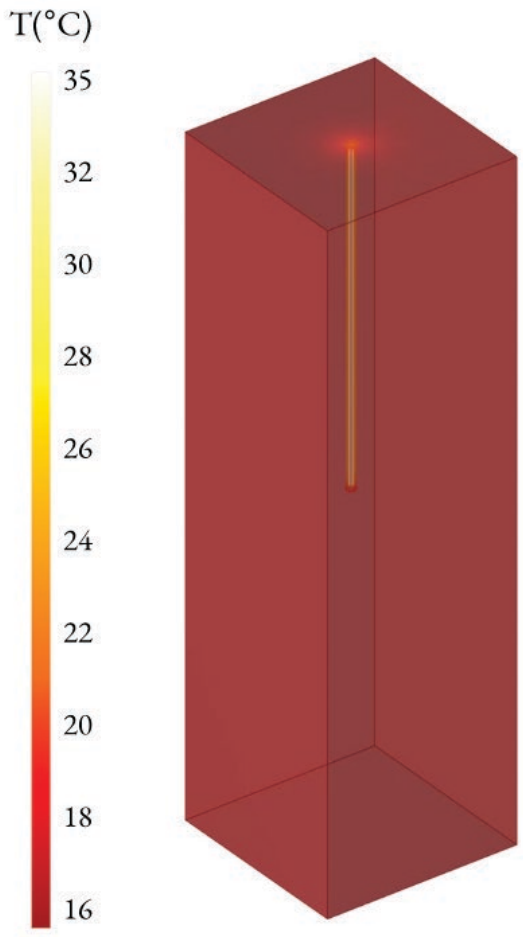


Technical details and benefits

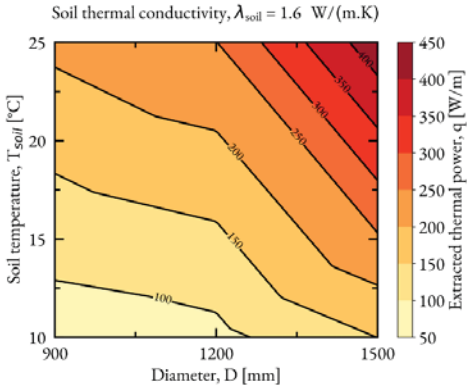
- Once piling is complete, the central void is filled with water, which has a high specific heat capacity
- The pile diameter governs the total number of heat transfer loops installed into the void, connected to a single inlet and outlet port
- A detailed design ensures optimum performance for the entire building system
- A conservative modelling approach ensures the system can meet building requirements in the short, medium and long-term based on accurate and realistic load profiles
- During operation thermal energy provides space heating and cooling as well as hot water
- Hiperpile transfers heat energy to and from the ground, utilising the consistent ground temperatures below 5m
- High coefficients of performance (COP) are delivered through the GSHP water-based system
- Hiperpiles store waste energy within the water filled void making them valuable for local heat networks
- For consistent, long-term performance optimal efficiencies are ensured through load balancing and/or supplementary sources (Solar/Air-source)
- An integrated approach is taken to incorporate the ground source energy into the wider M&E building management system (BMS)

Tangible benefits

- Ground source energy achieves COP up to 6.0; twice that of typical air source systems
- A greater COP results in efficient and sustainable energy solutions, reducing operational costs and carbon emissions
- Hiperpiles are more efficient than traditional, geothermal techniques, providing greater peak loading capacity than energy boreholes and piles. See energy extraction table below
- Geothermal loops enable dual-capability foundation assets, providing heating and cooling that may be traded within an energy network
- High thermal conductivity and thermal store
- Reduced construction programme
- Significantly reduced risk of damage during follow-on works
- Design life of up to 50 years
- Verified through thermal response testing (TRTs)
- Performance guaranteed by warranty



$Re \approx 9000$, $T_{in} = 2°C$, Time = 12 h



Capacity	Short Term Capacity	Long Term Capacity	Electricity Saving
Dia (mm)	3 hours W/m	1 year W/m	£/m/annum
900	328	49	22
1200	383	53	23
1500	667	68	30

The above capacities assume typical ground conditions however these should not be used for design. The annual value expresses the typical saving in electrical energy over an air source system for the same output. Please contact us for further details.

In summary

The geothermal performance of Hiperpile is linked to variables such as building requirements, pile specifications, ground characteristics, and supplementary energy sources. Hiperenergy has the expertise to evaluate and provide recommendations for all scenarios. System design performances are supported by computer modelling, on-site testing, and warranties.

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Re-usable Pile

Revolutioning construction with sustainability at our core

→ Redefining sustainable construction

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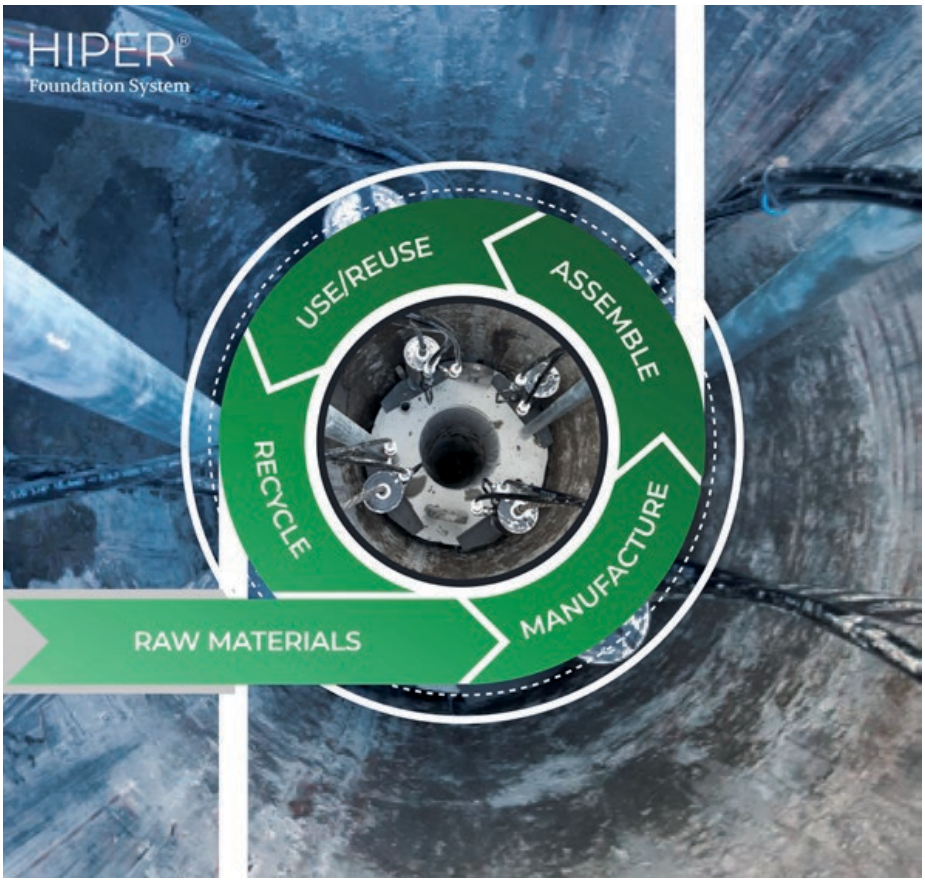
Re-usable Pile

Reused and Redefined

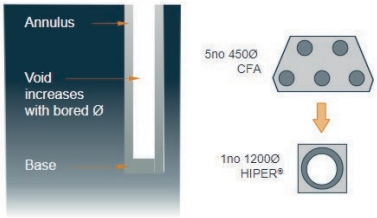
Revolutionising construction with sustainability at our core

Hiperpile's align with circular economy principles to support the reuse of foundations beneath new and renovated structures.



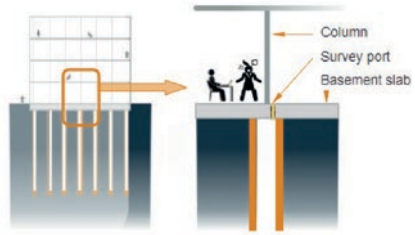
Construction Phase:

- 30-70% material reduction
- Larger, shallow mono-hollow piles
- Elimination or reduction of pile caps



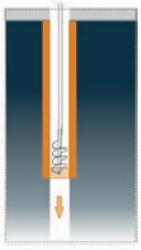
Decommissioning Phase:

- Inspection during occupancy
- Assessment for re-use early in project cycle



Reuse:

- Extend for higher future loads
- A circular economy foundation
- A circular economy



Existing piles on heavily redeveloped brownfield sites are frequently removed to allow the construction of larger, deeper piled foundations.

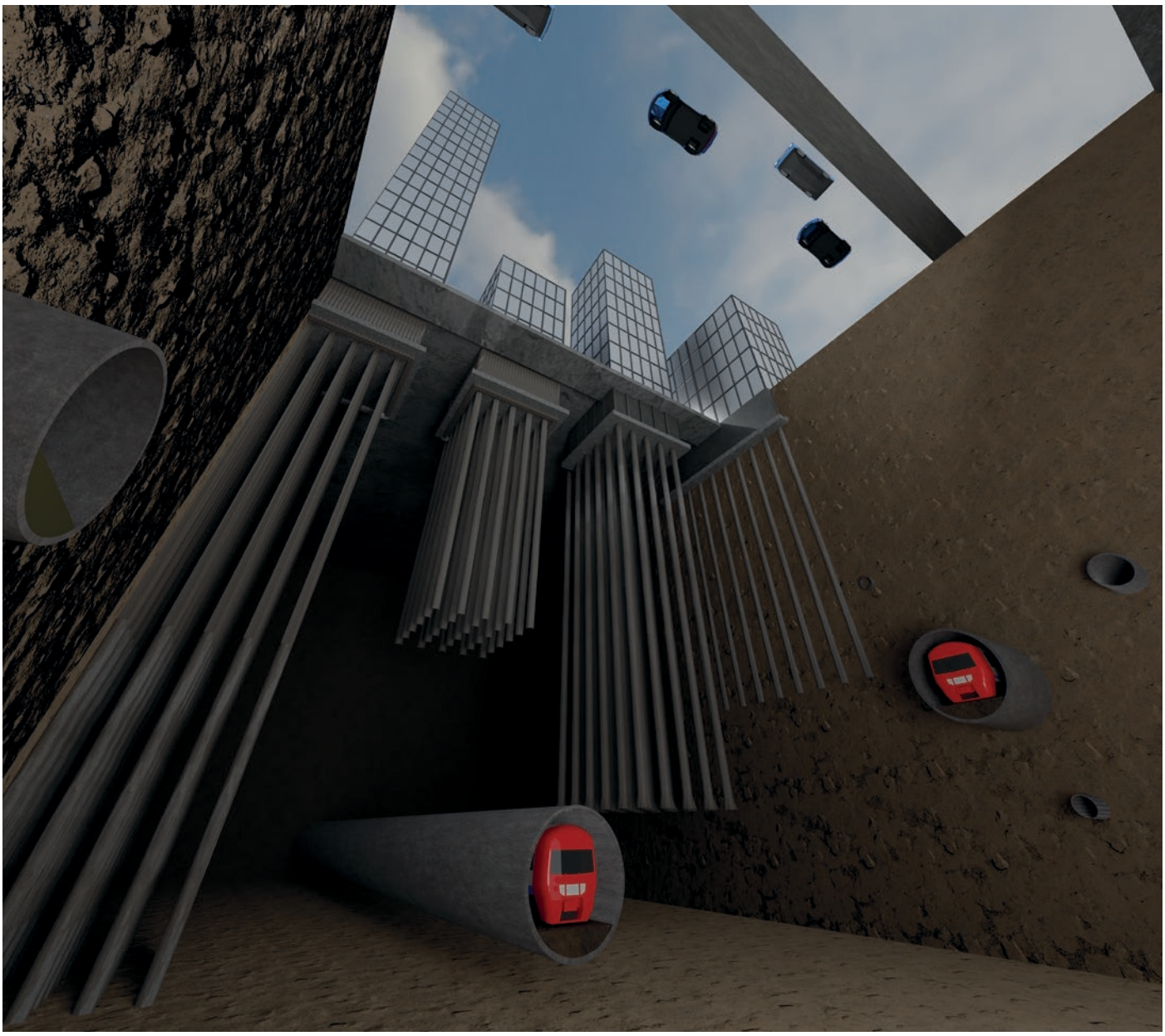
The Hiperpile's unique void allows the pile to be inspected, monitored and structurally validated. This information allows the Hiperpile to be re-warranted, enabling practical reuse and preserving the foundation at its highest value.

Technical details and benefits

- Eliminates any future requirement to remove the Hiperpile, owing to its unique ability to be inspected and re-warranted
- Eliminates the requirement for supplementary additional piles with the Hiperpile's unique ability to be extended
- If required, additional structural capacity can be achieved by in-filling the void
- Enables the uptake of standardised building grid-layouts in future developments

Tangible benefits

- A product that supports circular construction and contributes to a long-term reduction in embodied carbon
- Life-cycle extension and whole life carbon reduction
- Eliminate costly and disruptive coring activities associate with traditional solid pile removal
- In-situ pile monitoring supports the application for re-use warranties



In summary

Hiperpile truly redefines piled foundations as long-term, building assets.
The value provided is multiplied through its multifunctional use, reuse and potential for enhanced capacity for future generations.
Hiperpile is a practical readily available foundation solution which enables a carbon negative, climate positive future.

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